Contributions to the Knowledge of the Alpheid Shrimp of the Pacific Ocean

Part VII. On *Metabetaeus* Borradaile, with a New Species from Hawaii[1]

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The genus *Metabetaeus* was described by Borradaile (1898: 1014) to contain the species originally described by Whitelegge (1897: 147) as *Betaeus minutus*. These descriptions and Coutière's subsequent discussion of the genus (1899: 374) were all based on a series of specimens collected at Funafuti in the Ellice Archipelago. Nothing more on either the genus or the species was recorded until R. W. Hiatt collected additional specimens of the species in a brackish pond at Arno in the Marshall Islands (Banner, 1957: 193).

Since the publication of the 1957 paper, additional specimens belonging to this genus have been observed alive and collected. *M. minutus* was taken from two different islets on Jaluit in the Marshall Islands during a trip in April, 1958, to observe typhoon damage on that atoll. The trip was sponsored by the Office of Naval Research, the Pacific Science Board, and the Bernice P. Bishop Museum.

More interesting is a new species of the genus collected from one locality on the island of Hawaii. The first several specimens came to us from the collections of the Bishop Museum; they had been collected in a pool in the Ka'u district of Hawaii by E. H. Bryan, Jr., Marian Kelly, and William Meinecke. In February, 1958, we collected more specimens from this pool. Many other pools, both in the Ka'u district and in other areas on other islands, were investigated, but no more specimens of this species were seen.

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Metabetaeus lohena sp. nov.
Fig. 1

Specimens: Type specimen, an ovigerous female 16.6 mm. long; paratypes, 5 specimens collected by the authors and 4 other specimens collected by Bryan, Kelly, and Meinecke.

Type locality: All specimens came from a pool in the base of the rock known to the Hawaiians as Lohena, a few hundred yards from shore between the deserted villages of Wai-o-ahu-kini and Ka'ili-ki'i, immediately west of Ka Lae or South Point on Hawaii. Lohena is a rock perhaps a hundred or more feet in diameter surrounded by the boulders of an a'a lava flow; in its base are several fissures, one of which is a cave about 30 ft. long, 10 or 12 ft. wide at the mouth and 15–20 ft. high; the pool of brackish water is 4–6 ft. deep in the bottom of the cave.

Description: Carapace rounded dorsally, without grooves or keels. Rostrum acute with tip reaching to middle of first antennular article; dorsal surface rounded, lateral margins posteriorly concave. Supraorbital spines acute, half as long as rostrum. Eyes completely concealed in dorsal and lateral aspects; pigmented portions of corneas greatly reduced. Pterygostomial margin rounded.

Cardiac notch wanting; pleura of sixth abdominal somite articulated.

Second article of antennular peduncle as long as broad, shorter than visible portion of first, and longer than third article; flagella about as long as carapace. Stylocerite acute, with tip reaching to end of first antennular article.

Basicerite with strong, acute tooth below articulation of scaphocerite. Scaphocerite with

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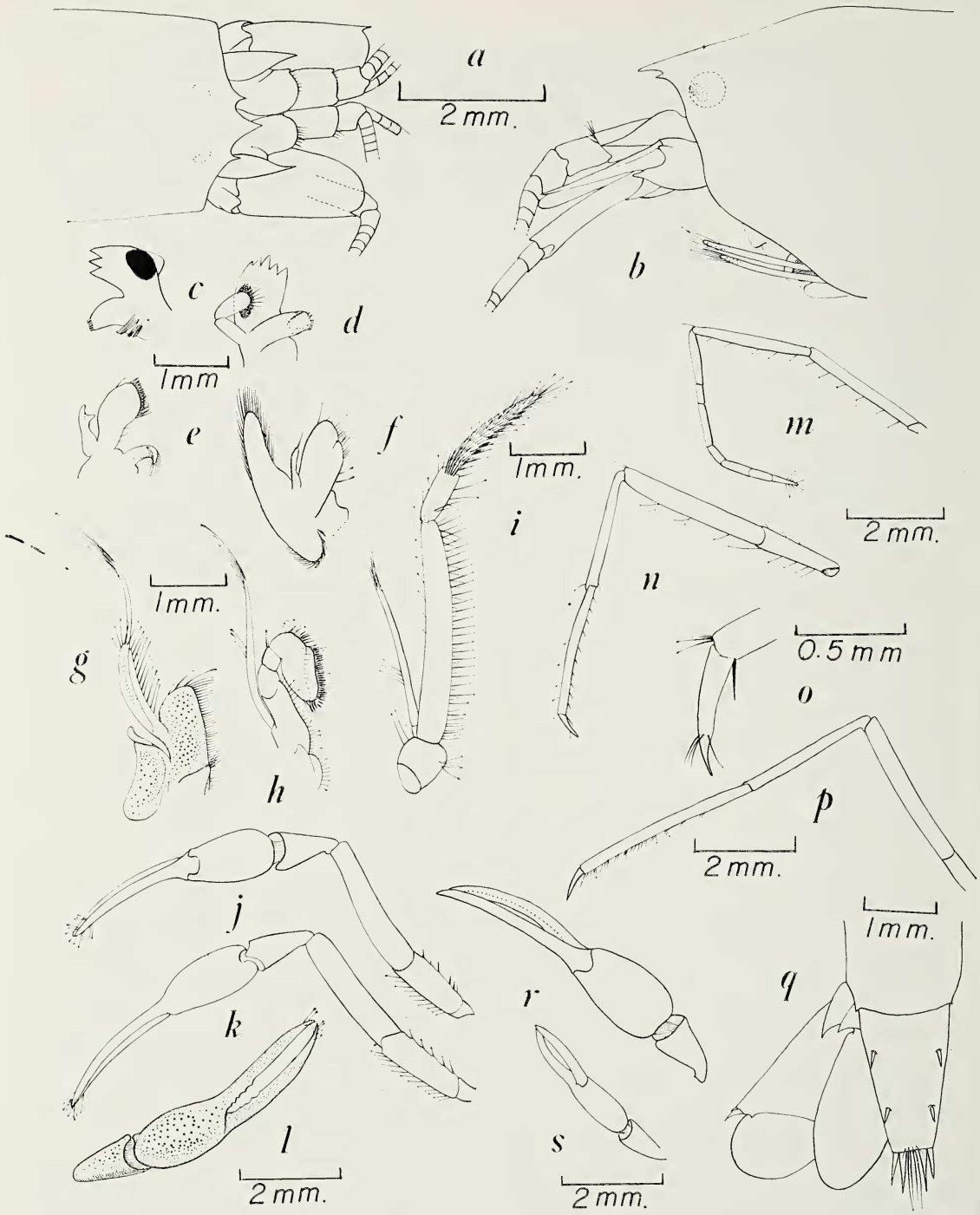

FIG. 1. *Metabetaeus lohena* Banner. *a, b,* Anterior region, dorsal and lateral aspects; *c, d,* mandibles; *e,* first maxilla; *f,* second maxilla; *g,* first maxilliped; *h,* second maxilliped; *i,* third maxilliped; *j,* left chela, outer side; *k,* right chela, inner side; *l,* left chela, upper side; *m,* second leg; *n,* third leg; *o,* dactylus, third leg; *p,* fifth leg; *q,* telson and uropods; *r, s,* paired chelae of a nonovigerous 18.4 mm. female.

lateral tooth of moderate development, about equal in length to rounded portion; squamous portion reaching to end of antennular peduncle. Carpocerite slightly longer than both antennular peduncle and scaphocerite; flagellum somewhat longer than body.

Mandibles of normal form but bearing a large oval black spot on the body of the mandible; black spot with sharp margins and persistent even after preservation in alcohol. Maxillule with outer lobe without setae or spines, but with two heavy, thickened lobes, somewhat similar in form to a bottle opener. Other mouth parts showing only minor differences from those normal to the family.

Chelipeds symmetrical, enlarged. Ischium 3 times as long as broad, bearing on superior margin a row of short spines, on inferior margin a row of setae. Merus unarmed, 5 times as long as broad, slightly over twice length of ischium. Carpus subconical, proximally small in diameter, distally 3 times the proximal diameter; distal margins somewhat collarlike around base of propodus; articles without spines. Palm of chela somewhat inflated, subcircular in cross section, 1.6 times as wide at maximum diameter as long. Fingers long, slender, curved, 1.5 times length of palm; proximally both fingers armed with low, widely spaced teeth.

Second legs long and slender, ischium and merus equal in length and both about 10 times as long as broad. Sum of lengths of first three carpal articles equal in length to merus; ratio of the carpal articles is 10:3.5:8:3.5:5. Fingers of chela subequal in length to last carpal article, slightly longer than palm.

Third legs slender. Ischium unarmed, except for scattered setae, almost 4 times as long as broad. Carpus unarmed, 0.8 as long as merus, about 0.6 as broad. Propodus also slender, slightly curved, tapering very slightly distally, 1.1 times as long as carpus, and bearing 10 slender, fine spines along inferior margin. Dactylus simple, slender, acute, 0.2 as long as propodus.

Fourth and fifth legs similar to, but progressively longer, than third. "Brush" on propodus of fifth legs well developed.

Telson twice as broad at base as at tip, and 3 times as long as broad at tip; lateral and terminal margins almost straight; dorsal surface slightly convex. Spines heavy with medial pair of terminal spines about as long as tip is broad; lateral pair slightly shorter; middle portion of tip with small tuft of plumose setae. Uropods normal in form, lateral spine of outer branch strong.

Color in life from a brilliant to a pale salmon red, with the black mandibular spot conspicuous.

DISCUSSION: These specimens show a variation in the form of the chelipeds reminiscent of the species of *Athanas*. Mature males and females have chelae as described above; slightly smaller specimens of both sexes have a large and a small chela (Fig. 1*r*, *s*); small specimens have both chelae similar to the smaller one of the asymmetrical pair. No other marked variation was noted with sex or maturity.

The differences between this species and *M. minutus* are few but conspicuous (contrast Fig. 1 and Fig. 2). The stylocerite of *M. lohena* reaches to the end of the first antennular article, that of *M. minutus* to the middle of the second; the scaphocerite reaches to the end of the antennular peduncle on this species, to the middle of the third article on *M. minutus*. More important are the differences in the chelae, with none of the numerous specimens of *M. minutus* showing the enlarged chelae; and with the fingers in all definitely shorter than the palm, while in *M. lohena* both the large and small type of chela have fingers longer than the palm; also, in *M. minutus* the fingers are quite straight and heavy, while in *M. lohena* the fingers are slender and show at least some curvature. Another possible difference is the degree of coverage of the eyes, with the eyes completely concealed in all specimens of *M. lohena,* and with them usually protruding in some degree from under the carapace in *M. minutus;* however, as the eyes may be rolled forward and backward, this characteristic should not be relied upon. There are no other conspicuous differences in the morphology of the two species. The color in life of the two species, including the black mandibular spot, is the same.

They are also similar in their environments. The habitat of *M. lohena* is described above; while surface layers of the water in the undisturbed pond were almost fresh, the under layers

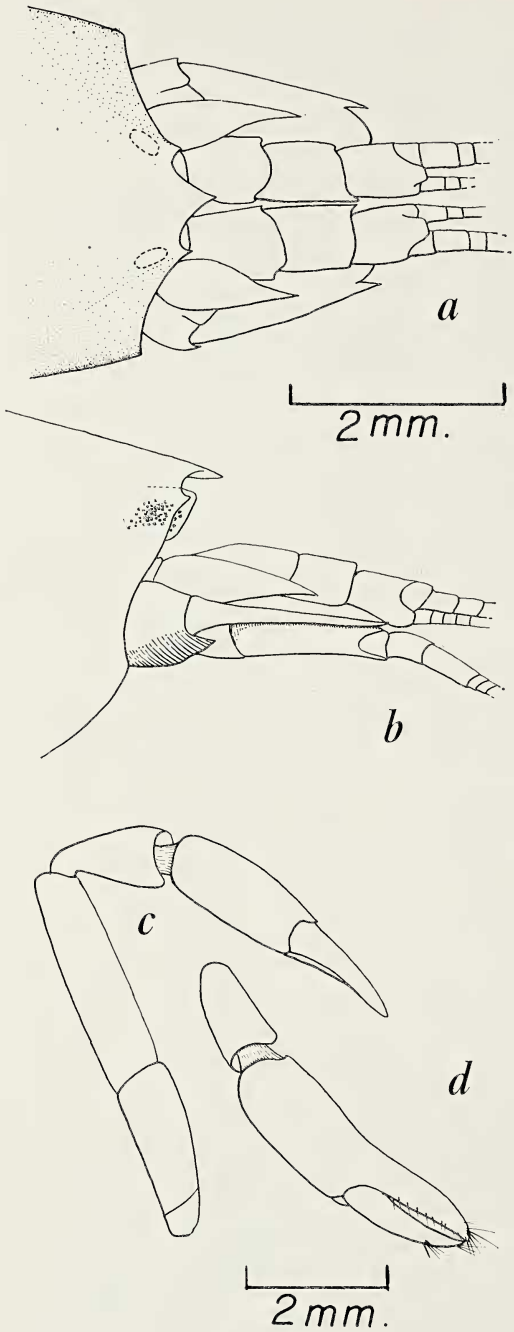

FIG. 2. *Metabetaeus minutus* (Whitelegge). *a, b,* Anterior region, dorsal and lateral aspects; *c,* cheliped; *d,* chela, outer face.

were definitely brackish, and the level of the water in the pool changed with the tides.

M. minutus was collected in two pools on Jaluit. On the islet of Medyado it was found in a mangrove swamp; the base of this swamp was an old reef flat, cut off from both the ocean and the lagoon by boulder and sand ramparts, and through the coral platform flowed definitely brackish water, rising and lowering not only with the tide but also with rapid periodicity of the waves on the ocean reef. The water flowed in and out through a series of ragged holes, and it was in these holes that the shrimp hid, emerging to the surrounding pools when unmolested. On Jabor the shrimp were found in a bomb crater in the center of the islet; the crater was almost dry at low tide and the shrimp were withdrawn into the holes of the coral at the base; but at high tide, when it was almost waist deep with brackish water, the shrimp emerged in great numbers.

However, in the ecology of the pools the two species appear to play entirely different roles. In the pool of Lohena there were two species of shrimp found; the smaller and much more abundant atyid was identified by Rathbun (1906: 919) as *Caridina brevirostris* Stimpson and the larger as *Metabetaeus.* The atyid, abundant in pools of subterranean origin about the Hawaiian Islands, is an herbivore evidently feeding upon the algae growing on the rocks of the pools and upon vegetable detritus falling into the pool. When undisturbed it settles in large numbers on rock surfaces, occasionally walking or swimming from rock to rock. The alpheid, about twice the size of the atyid, usually hides in the rubble at the bottom of the pool, or in cracks in its side, and makes sudden forays to capture the atyid in its long rapacious chelae. It carries the struggling atyid in its chela towards its mouth and disappears again into a hiding place, presumably to eat its prey.

On the other hand, while in the pools of Jaluit there was also an atyid (not as yet identified); the mature atyid and alpheid were of nearly the same size, and the alpheid was by far the more abundant and gave no evidence of predatory habits. Like the *Caridina* in Hawaiian pools, *M. minutus* would emerge to rest on the rocks and vegetable debris in the pool;

they were never seen attacking other shrimp. When the senior author stood bare-legged in the pool while collecting, shrimp settled on his leg and produced a feeling similar to a gentle rasping rather than pinching. In the food groove between the bases of the thoracic legs and among other mouth parts were found sand and detritus. Therefore, they are presumed to be other than carnivorous.

Coutière remarked that in his specimens of *M. minutus* there were spots similar in color to the mandibular spots found about the gill chambers and other parts; he suggested that they were caused by symbiotic zooxanthellae. In none of these specimens of either species were there spots other than the mandibular spots and the normal red chromatophores; moreover, in view of the habit of these shrimp, of living in darkness or semidarkness, it is unlikely that they would have an association with symbiotic algae.

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